

—The role should be to act as an identifier of opportunities and broker, not a long term participant.

Conclusion

- Australian Science Policy in general is sound and meets most of the desirable attributes.
- Government outlays on science are substantial and must be continuously monitored to ensure that they are yielding the optimum return for taxpayers.
- Science policy will only be effective when considered as a component of other government policies, as a means to achieving various social and economic objectives. It is not an end in itself.

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AUSTRALIA'S SCIENCE POLICY

The nature of science

Ever since human beings started to cultivate crops in the fertile crescent some 8 millennia ago, and probably long before that, humans have expressed their desire to understand and, if possible, conquer nature. The yearning for greater understanding seems to be buried deeply within human consciousness. The most accurate birthday to assign to the birth of science is the birthday of *Homo sapiens*, which seems to keep fluctuating but at a best guess is about a million years ago. I hold unshakably to the belief that science is primarily about ideas, is integrally involved with the quest for greater knowledge of the world around us and of ourselves. This being said, it seems undoubted that there was a major acceleration in the activity that we call scientific research stemming from about the time that Galileo died and Newton was born, i.e. the last 300 plus years. Few would deny the proposition that steep acceleration in scientific activity was occasioned by the industrial revolution and two world wars.

Faustian bargains in science

Thus we see that from the dawn of the scientific age there are issues to be faced at the interface of science and technology. Knowledge is desirable and good, but scientific knowledge is somehow categorically different from other sorts of knowledge in that it is vectorial, incrementally verifiable

and ineffably powerful. Scientific insights that brook no contradiction lead to powers that know no limits. It is actually interesting to reflect on the number of occasions that scientists have misread the implications of their own work. Rutherford thought that atomic physics was an interesting intellectual exercise. Marconi thought that wireless would be useful for ship to shore communication. The scientists from Rhone-Poulenc who invented the world's first major drug for the treatment of psychoses thought they were inventing an anti-shivering agent for cardiac surgery. Many scientists who love the world of ideas, who struggle to reach insights before their competitors, have no particular concern for where the discovery might eventually lead humanity.

Science Policy thus a house of cards

This being the case, science policy has to be built on shifting sands. There is a tremendous temptation to force the scientific enterprise into a modality that is technological rather than scientific. There will be a time in the development of any science that the technological and practical spin-offs become obvious. There will also be joyous, intellectually challenging, fascinating and fantastic things requiring to be done within the domain of technology for society to get the maximum dividend from scientific discoveries. Nor is it a simple linear sequence. Frequently, the problems and challenges that emerge as scientists struggle to make breakthroughs from the world of ideas practically useful in the world of human beings and their daily concerns will feed back to the basic scientists undreamt of challenges. An enlightened science policy will take due heed of these imperatives.

Australia's position in science and technology

For reasons that are not easy to discern, the great effort that went into Australian science and technology between the years 1930 and 1980 was somewhat slanted towards the fundamental end of the science and technology spectrum. Starting with CSIRO, moving onto the Australian National University, and finishing with the enormous upsurge of the Australian universities after the Murray Report and Martin's assumption as head of the Australian Universities Commission, we have a situation in Australian research where the basic science end is fantastic, where a certain applied research capacity exists, but where there is a significant lack of recipient vehicles within

Australian industry to derive the maximum advantage for the economic benefit of the nation of indigenous Australian discoveries. Of course, the great exceptions are the primary industries, agriculture and mining.

The last decade's great pendular swing

Progressive recognition that Australia seemed not to be getting sufficient economic, social and environmental benefit from its R&D effort, and that many good opportunities for commercialisation had gone overseas, has engendered over the last decade or so a pendular swing towards research for practical ends. This has been largely, but not entirely, driven by Government policy, including the CRC movement, the 150% tax deductibility for R&D, syndicated R&D schemes, GIRD grants, the 30% external earnings imperative of CSIRO and specialised schemes such as Factor F. Strapped for cash, the academic community has vigorously embraced the new collegiality with the industry sector. In fact, I believe Government is not aware just how far universities in particular have moved. The problem is that the business sector itself has not moved as fast, and recent surveys show the continuation of scepticism about R&D in many business enterprises. Nevertheless, the growth rates of business expenditure on research and development show a heartening trend from a low base.

The risk of swinging too far

As with all pendular swings, the risk is that the change in emphasis may have gone too far. The continuing malaise within CSIRO is just the tip of the iceberg. There is a loud minority view within CSIRO that strategic science has been threatened by recent Board policy. Within the universities, the citation impact studies of Bourke and Butler suggest that we are publishing as much, but that our research may be losing some of its edge. At the coal-face, competition for NH&MRC and ARC grants has never been tougher and among our young people within universities there is a real sense of embattlement. We are giving the wrong signals to young Australians at the very time when, at long last, the rhetoric of both Government and Opposition is placing science, technology and innovation high up on the national agenda. Bodies like the Australian Academy of Science and The Royal Society of Victoria must be prepared to stand up and be counted in insisting for a continued high profile

of fundamental research within the nation, because this is, indeed, the crucible from which all applied discoveries emerge.

The danger of talking to ourselves

One problem with the science policy debate in Australia is that we spend a great deal of time and effort in preaching to the converted. We should be working hard as ambassadors for science in our general lives, within our communities, and most particularly with sceptical decision-makers who have not yet become as convinced about the value of R&D as we are ourselves. Foremost among these are the senior economic bureaucrats and business and industry leaders. Interestingly, politicians do seem to have got the message. At the wider community level, education about the importance of scientific principles has to begin as early as possible. The Academy of Science, as well as its traditional interest in secondary school education, is now heavily involved with primary school science education as well. This is long-term work of enormous significance.

Minister Cook's innovation statement

Now that the budget has been brought down, and found to be largely neutral in terms of science and technology development through Government funding, the next major focal point has to be Minister Cook's Innovation Statement. At a recent speech before the Australian Academy of Science, Minister Cook declared that he had so far received little help by way of new ideas from the science community. He described in some detail the difficulty of a Government which does want to sponsor science and technology but finds itself surrounded by advice to get its own spending down. In other words, any new initiative which might be proposed that would cost the Government money would have to be accompanied by suggestions about what spending should be cut. This leaves us with a challenge of tendering advice as to how the Government could spend money 'smarter' rather than just simply spending more money on research and development. One useful outcome of the present symposium might be to float some ideas which could be included in the Innovation Statement. I would undertake to pass these on to the Minister for examination. I intend during my speech to make a few suggestions of my own for what could be in the Innovation Statement.